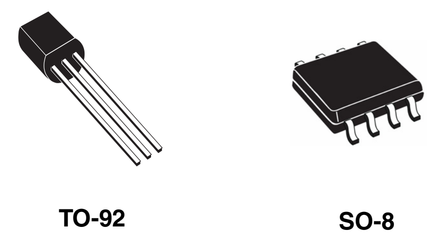
LM217L
LM317L

Low current 1.2 to 37V adjustable voltage regulator

Features

- Output voltage range: 1.2 to 37V
- Output current in excess of 100 mA
- Line regulation typ. 0.01%
- Load regulation typ. 0.1%
- Thermal overload protection
- Short circuit protection
- Output transition safe area compensation
- Floating operation for high voltage applications



Description

The LM217L/LM317L are monolithic integrated circuit in SO-8 and TO-92 packages intended for use as positive adjustable voltage regulators.

They are designed to supply until 100 mA of load current with an output voltage adjustable over a 1.2 to 37V range.

The nominal output voltage is selected by means of only a resistive divider, making the device exceptionally easy to use and eliminating the stocking of many fixed regulators.

Order codes

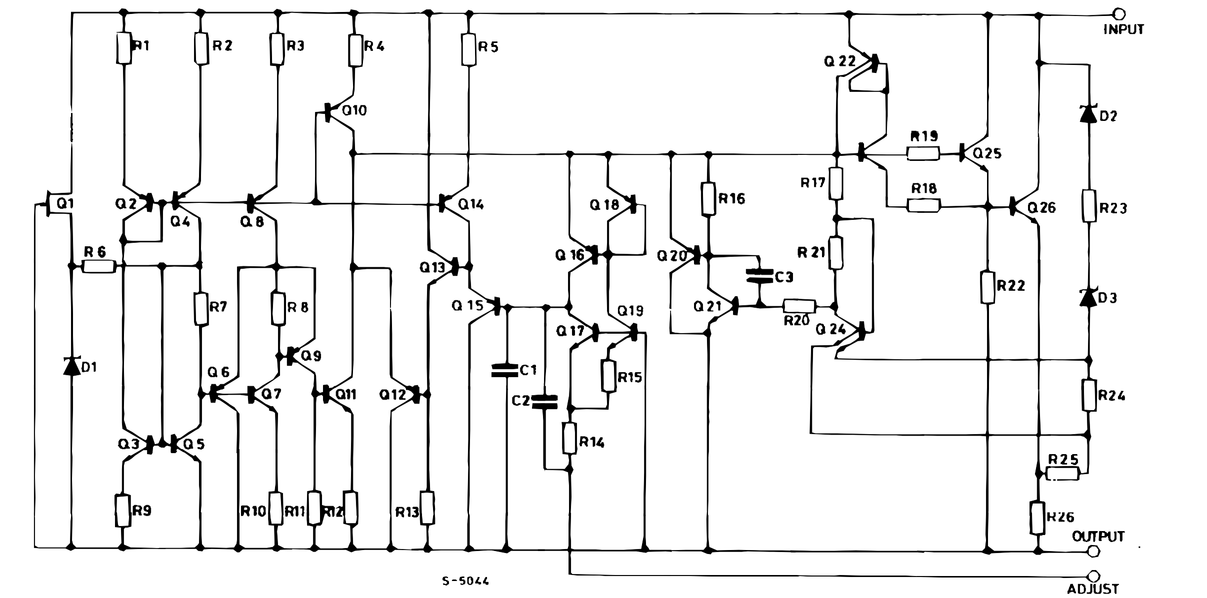
Part numbers	Packages	
	SO-8 (Tape & reel)	TO-92 (BAG) (1)
LM217L	LM217LD13TR	LM217LZ
LM317L	LM317LD13TR	LM317LZ

1. Available in tape & reel with the suffix "-TR" and in Ammopak with the suffix "-AP". Please note that in these cases pins are shaped according to tape & reel specifications

Contents

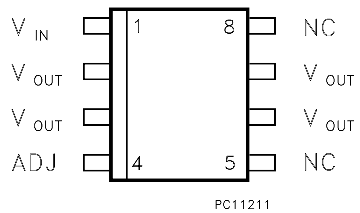
1 Diagram

Figure 1. Schematic diagram

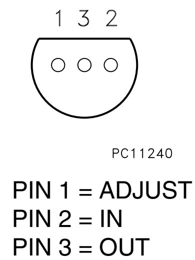


2 Pin configuration

Figure 2. Pin connections (top view for SO-8, bottom view for TO-92)



SO-8



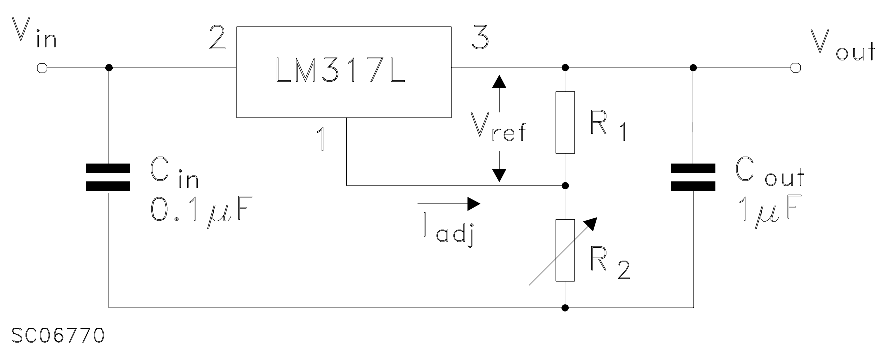
TO-92

3 Maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter		Value	Unit
V_I-V_O	Input-output differential voltage		40	V
P_D	Power dissipation		Internally Limited	mW
T_{OP}	Operating junction temperature range	for LM217L	-40 to 125	°C
		for LM317L	0 to 125	
T_{STG}	Storage temperature range		-55 to 150	°C

Figure 3. Test circuit



4 Electrical characteristics

Table 2. Electrical characteristics of LM217L (refer to the test circuits, T_J = - 40 to 125°C, V_I - V_O = 5 V, I_O = 40 mA, unless otherwise specified)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
ΔV_O	Line regulation	V_I - V_O = 3 to 40 V I_L < 20 mA	T_J = 25°C		0.01	0.02	%/V
					0.02	0.05	
ΔV_O	Load regulation	$V_O \leq 5$ V I_O = 5 to 100 mA	T_J = 25°C		5	15	mV
					20	50	
		$V_O \geq 5$ V I_O = 5 to 100 mA	T_J = 25°C		0.1	0.3	%
					0.3	1	
I_{ADJ}	Adjustment pin current				50	100	µA
ΔI_{ADJ}	Adjustment pin current	V_I - V_O = 3 to 40 V, I_O = 5 to 100 mA P_d < 625 mW			0.2	5	µA
V_{REF}	Reference voltage	V_I - V_O = 3 to 40 V, I_O = 10 to 500 mA P_d < 625 mW		1.2	1.25	1.3	V
$\Delta V_O/V_O$	Output voltage temperature stability				0.7		%
$I_{O(min)}$	Minimum load current	V_I - V_O = 40 V			3.5	5	mA
$I_{O(max)}$	Maximum output current	V_I - V_O = 3 to 13 V		100	200		mA
		V_I - V_O = 40 V			50		
eN	Output noise voltage	B = 10 Hz to 10 KHz, T_J = 25°C			0.003		%
SVR	Supply voltage rejection (1)	T_J = 25°C f = 120 Hz	C_{ADJ} = 0		65		dB
			C_{ADJ} = 10 µF	66	80		

1. C_{ADJ} is connected between adjust pin and ground.

Table 3. Electrical characteristics of LM317L (refer to the test circuits, T_J = 0 to 125°C, V_I - V_O = 5 V, I_O = 40 mA, unless otherwise specified)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
ΔV_O	Line regulation	V_I - V_O = 3 to 40 V I_L < 20 mA	T_J = 25°C		0.01	0.04	%/V
					0.02	0.07	
ΔV_O	Load regulation	V_O ≤ 5 V I_O = 5 to 100 mA	T_J = 25°C		5	25	mV
					20	70	
		V_O ≥ 5 V I_O = 5 to 100 mA	T_J = 25°C		0.1	0.5	%
					0.3	1.5	
I_{ADJ}	Adjustment pin current				50	100	µA
ΔI_{ADJ}	Adjustment pin current	V_I - V_O = 3 to 40 V, I_O = 5 to 100 mA P_d < 625 mW			0.2	5	µA
V_{REF}	Reference voltage	V_I - V_O = 3 to 40 V, I_O = 5 to 100 mA P_d < 625 mW		1.2	1.25	1.3	V
$\Delta V_O/V_O$	Output voltage temperature stability				0.7		%
$I_{O(min)}$	Minimum load current	V_I - V_O = 40 V			3.5	5	mA
$I_{O(max)}$	Maximum output current	V_I - V_O = 3 to 13 V		100	200		mA
		V_I - V_O = 40 V			50		
eN	Output noise voltage	B = 10 Hz to 10 KHz, T_J = 25°C			0.003		%
SVR	Supply voltage rejection (1)	T_J = 25°C f = 120 Hz	C_{ADJ} = 0		65		dB
			C_{ADJ} = 10 µF	66	80		

1. C_{ADJ} is connected between adjust pin and ground.

5 Typical performance

Figure 4. Current limit

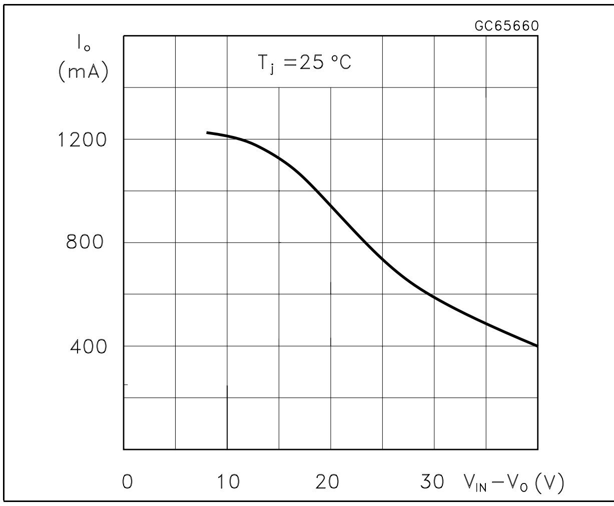
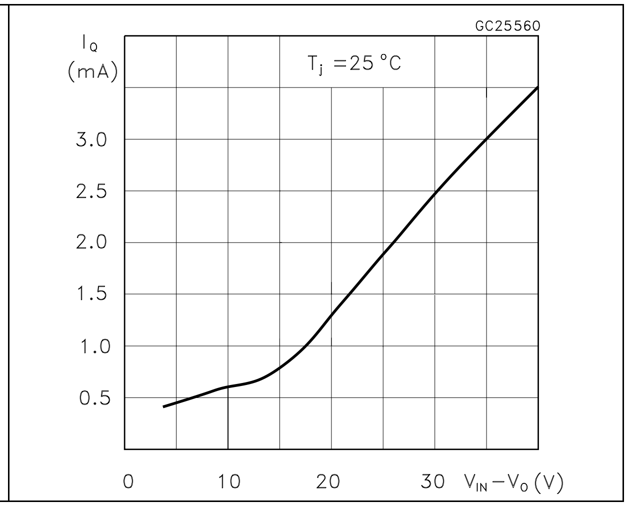


Figure 5. Minimum operating current



6 Application information

The LM317L provides an internal reference voltage of 1.25V between the output and adjustments terminals. This is used to set a constant current flow across an external resistor divider (see *Figure 4.*), giving an output voltage V_O of:

$V_O = V_{REF} (1 + R_2/R_1) + I_{ADJ} R_2$

The device was designed to minimize the term I_{ADJ} (100µA max) and to maintain it very constant with line and load changes. Usually, the error term $I_{ADJ} \times R_2$ can be neglected. To obtain the previous requirement, all the regulator quiescent current is returned to the output terminal, imposing a minimum load current condition. If the load is insufficient, the output voltage will rise.

Since the LM317L is a floating regulator and "sees" only the input-to-output differential voltage, supplies of very high voltage with respect to ground can be regulated as long as the maximum input-to-output differential is not exceeded. Furthermore, programmable regulator are easily obtainable and, by connecting a fixed resistor between the adjustment and output, the device can be used as a precision current regulator. In order to optimize the load regulation, the current set resistor R_1 (see *Figure 4.*) should be tied as close as possible to the regulator, while the ground terminal of R_2 should be near the ground of the load to provide remote ground sensing.

7 Application circuits

Figure 6. Basic adjustable regulator

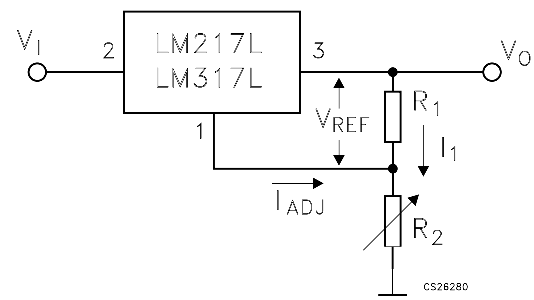


Figure 7. Voltage regulator with protection diodes

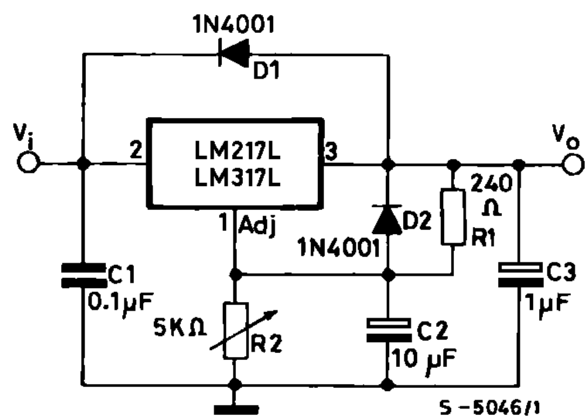


Figure 8. Slow Turn-on 15V Regulator

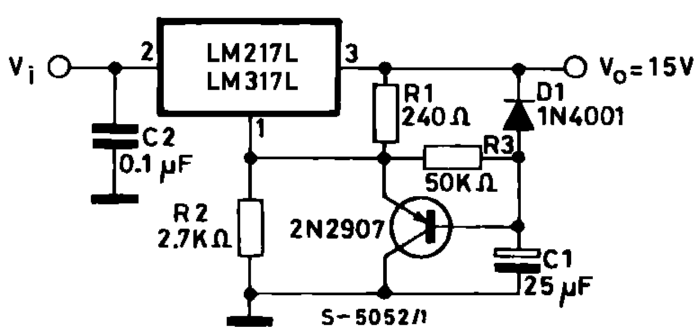
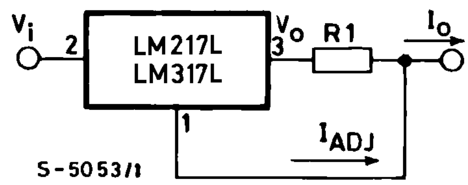


Figure 9. Current regulator



$I_O = V_{REF}/R_1 + I_{ADJ} = 1.25V/R_1$

Figure 10. 5V Electronic shut-down regulator

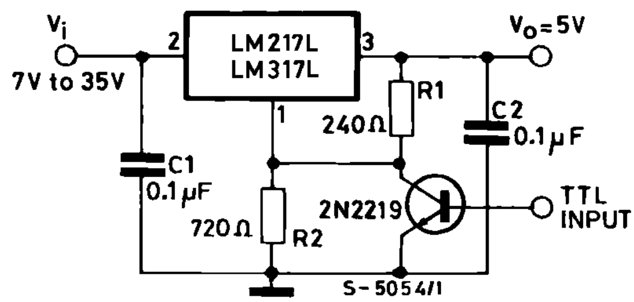
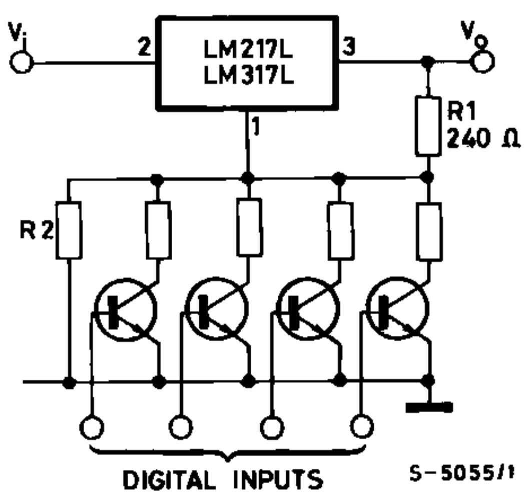


Figure 11. Digitally selected outputs



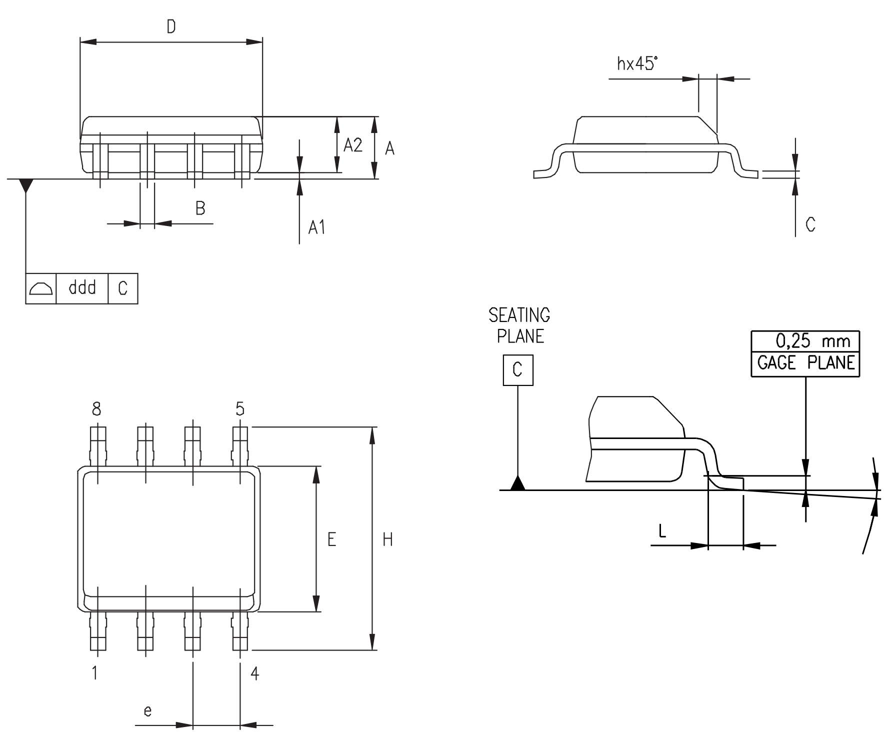
$(R_2 = \text{sets maximum } V_O)$

8 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

SO-8 MECHANICAL DATA

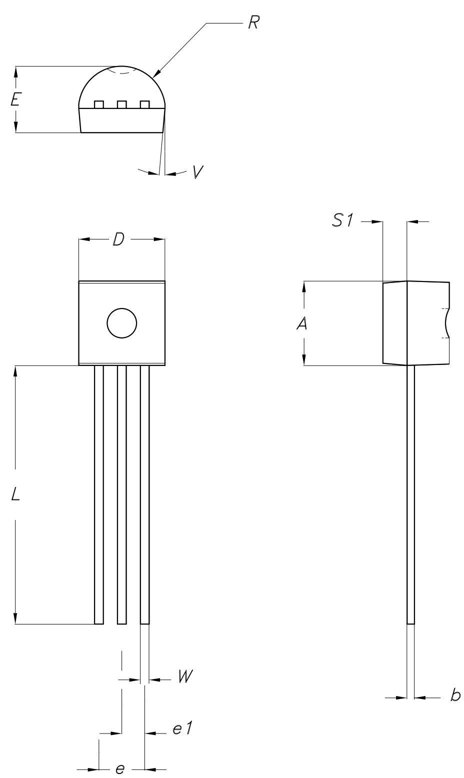
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.1			0.04



0016023/C

TO-92 MECHANICAL DATA

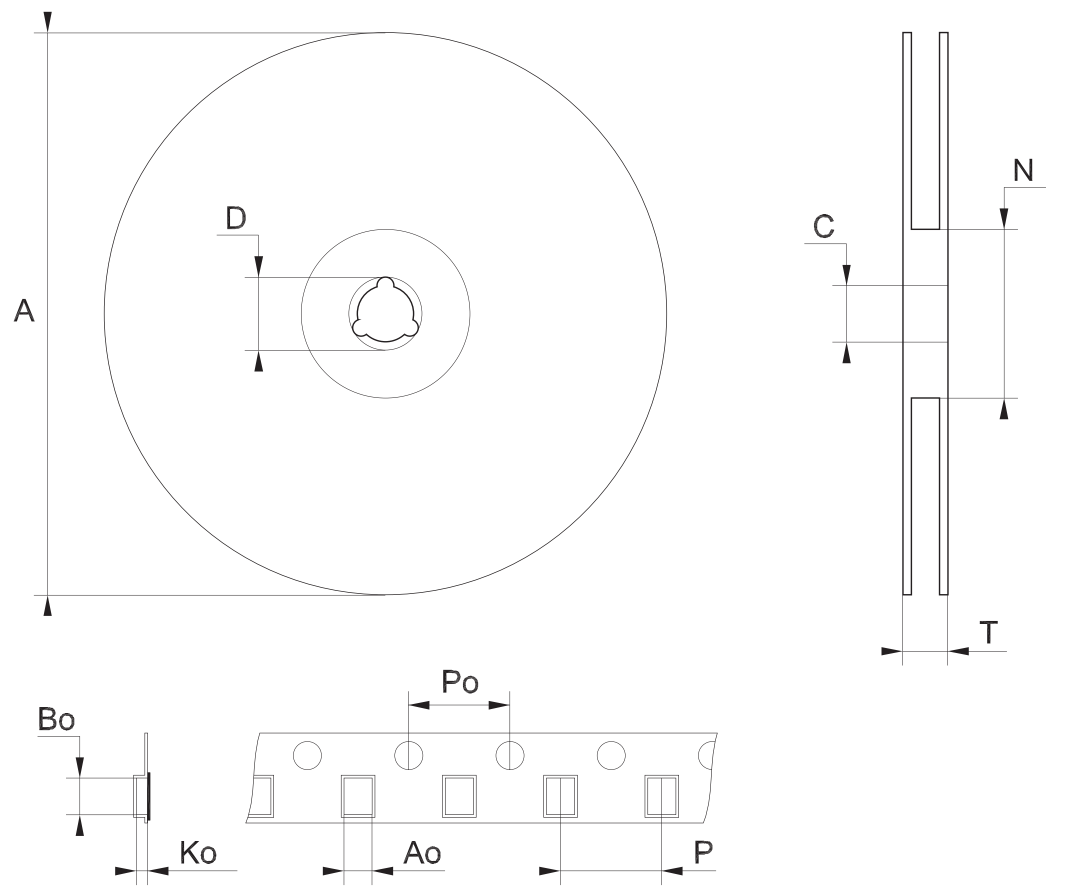
DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.32		4.95	170.1		194.9
b	0.36		0.51	14.2		20.1
D	4.45		4.95	175.2		194.9
E	3.30		3.94	129.9		155.1
e	2.41		2.67	94.9		105.1
e1	1.14		1.40	44.9		55.1
L	12.7		15.49	500.0		609.8
R	2.16		2.41	85.0		94.9
S1	0.92		1.52	36.2		59.8
W	0.41		0.56	16.1		22.0
α		5°			5°	



0102782/D

Tape & Reel SO-8 MECHANICAL DATA

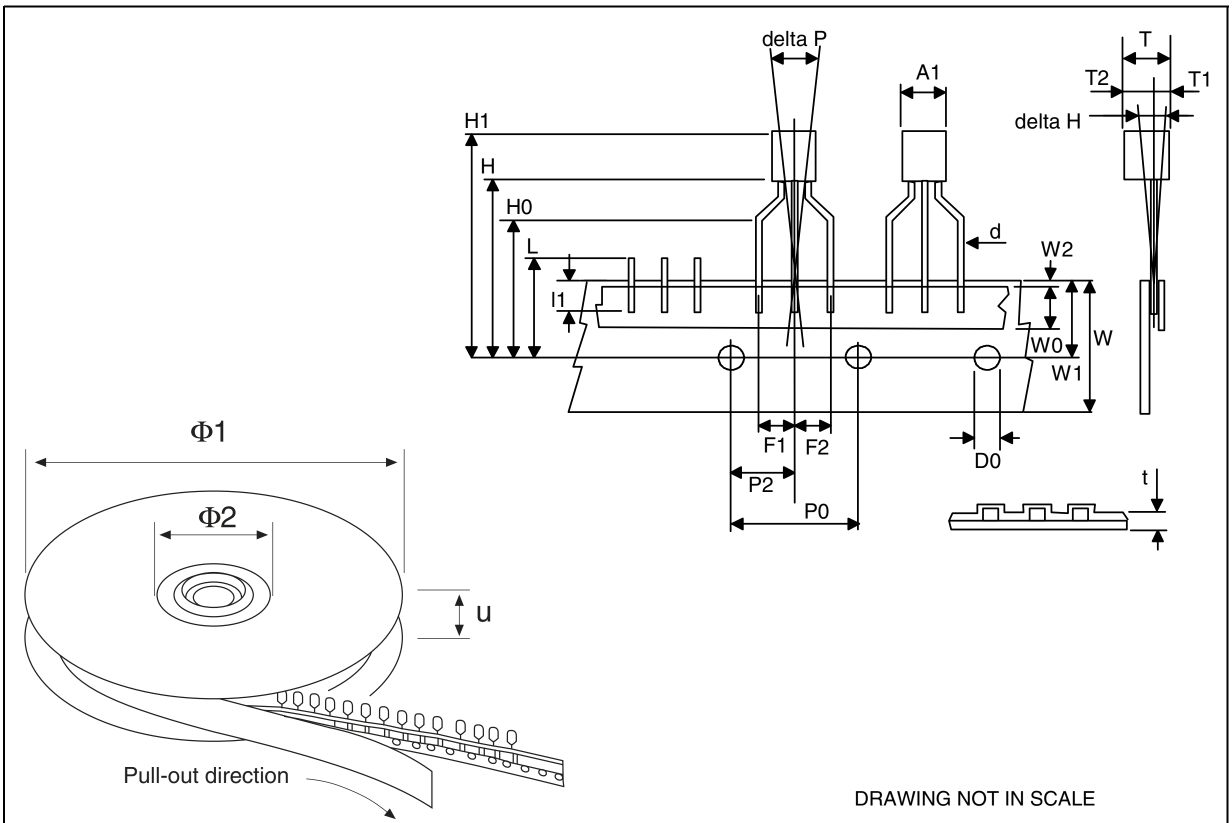
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	8.1		8.5	0.319		0.335
Bo	5.5		5.9	0.216		0.232
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



Note: Drawing not in scale

Tape & Reel for TO-92 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A1		4.80			0.189	
T		3.80			0.150	
T1		1.60			0.063	
T2		2.30			0.091	
d		0.48			0.019	
P0	12.5		12.9	0.492		0.508
P2	5.65		7.05	0.222		0.278
F1, F2	2.44	2.54	2.94	0.096	0.100	0.116
delta H		±2			0.079	
W	17.5	18.00	19.0	0.689	0.709	0.748
W0	5.7		6.3	0.224		0.248
W1	8.5		9.25	0.335		0.364
W2		0.50			0.20	
H		18.50	18.70		0.728	0.726
H0	15.50		16.50	0.610		0.650
H1		25.00			0.984	
D0	3.8		4.2	0.150		0.165
t		0.90			0.035	
L1		3			0.118	
delta P		±1			0.039	
u		50			1.968	
Φ1		360			14.173	
Φ2		30			1.181	



9 Revision history

Table 4. Revision history

Date	Revision	Changes
16-Mar-2005	2	Add Tape & reel for TO-92.
23-Dec-2005	3	Mistake on ordering table in header.
18-May-2007	4	Order codes has been updated and the document has been reformatted.